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Collaboration, Improvisation, and Memory

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Collaborative inhibition is defined as reduced memory performance when people collaborate in a group as compared to a non-collaborating (nominal) group of individuals. Collaborative inhibition is a robust effect that has been widely replicated; moreover, it has proven very difficult to attenuate or eliminate this effect. The present study was designed to determine whether collaborative inhibition persists in a situation where collaboration is central to the creation of the to-be-remembered stimuli. Across two experiments, participants were asked to improvise conversations/scenes and then recall them individually or collaboratively. Results and implications will be discussed.

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Collaboration, Improvisation, and Memory

by

Stephen Bromfield

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The report of the investigation undertaken as a
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Abstract

Collaborative inhibition is defined as reduced memory performance when people collaborate in a group as compared to a non-collaborating (nominal) group of individuals. Collaborative inhibition is a robust effect that has been widely replicated; moreover, it has proven very difficult to attenuate or eliminate this effect. The present study was designed to determine whether collaborative inhibition persists in a situation where collaboration is central to the creation of the to-be-remembered stimuli. Across two experiments, participants were asked to improvise conversations/scenes and then recall them individually or collaboratively. Results and implications will be discussed.

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1. Collaboration, Improvisation, and Memory

Imagine you and a friend plan a day trip in downtown Chicago; you decide that you'll go see the Field Museum and take the "L" to Wrigleyville to watch a Cubs game. You then grab dinner nearby and reminisce about your days from high school and other trips you've taken when you decide to see an improv show at IO and call it a night. Later, if someone asked you to recall your day, what you had done and what you discussed, do you think it would be easier to accurately remember most of your day with the help of your friend or simply on your own? You would probably recall more of your day if you were to do so collaboratively with your friend, after all two heads are better than one. But what if you and your friend were given the option of both separately recalling your day and then your two separate recollections could be added together? Would this method of recall yield a more accurate recollection than the recollection from a collaborative attempt?

In fact, two people collaborating on a memory recall task perform worse than when those same individuals recall separately and have their non-redundant performance combined, which is known as a nominal group. This phenomenon of collaborative group performance being worse than nominal group performance is known as *collaborative inhibition* (e.g., Andersson, Helstrup, & Rönnberg, 2007; Finlay, Hitch, & Meudell, 2000; Kelley, Reysen, Ahlstrand, & Pentz, 2012; Meade & Gigone, 2011; Weldon & Bellinger, 1997). Collaborative inhibition is a robust phenomenon (Basden, Basden, & Henry, 2000; Harris, Patterson, & Kemp, 2008; Thompson, 2007) and will be illustrated in the following pages by reviewing key research methods, manipulations, and results from noteworthy research in the field.

Early Investigations of Collaborative Inhibition

The basic methodologies for studying collaborative inhibition in a laboratory setting were developed by a variety of researchers in mid- to late-1990s. For instance, Andersson and Rönnberg (1995) performed two experiments where they analyzed collaborative recall in episodic memory. In their experiments, participants were asked to recall the same information on two successive tests, without an intervening study period. The first test always required individual recall, whereas the second test required individual recall, collaborative recall of pairs of friends, or collaborative recall of pairs of non-friends. In Experiment 1, participants were asked to freely recall word lists and stories, while Experiment 2 had participants watch and recall a filmed lecture on child development. Andersson and Rönnberg (1995) assessed the effects of collaboration on joint recall in episodic memory, the impact of friendship upon collaboration, and the complexity of the recalled material on performance. They did not form nominal (non-collaborating) groups in this study; they restricted the analyses to individual vs. collaborative-friend vs. collaborative-non-friend. Hence, the study could not assess collaborative inhibition, but it could assess whether two heads are better than one.

To be awarded credit for accurate recollection of the material, participants' recollections needed to be semantically similar to the target word (e.g., dog was considered correct when the target word was "Dalmatian"); for the stories, the main ideas needed to be present (Andersson & Rönnberg, 1995). There was a maximum score of 32 points for each experiment; one point was awarded for each correct answer. In Experiment 1, Andersson and Rönnberg (1995) found that the dyads, friends or non-friends, outperformed the individuals; word list recall performance for friends (M = 18.4) and non-friends (M = 21.0) was significantly higher than for individuals (M =

14.9). However, in Experiment 2 Andersson and Rönnberg (1995) found that the friends (M = 15.5) and non-friends (M = 13.1) mean story recall did not significantly differ from the individual recall (M = 11.9). This absence of a significant difference in means was attributed to the complexity of the tasks (Andersson & Rönnberg, 1995). In Experiment 1, participants recalled simple word lists, whereas in Experiment 2 more complex information was to be remembered in the form of details of stories demonstrating that the type of task does affect the percentage of correctly recalled items regardless of group condition (Andersson & Rönnberg,, 1995).

When looking at the differences between the friends and non-friends dyads, Andersson and Rönnberg (1995) also analyzed the number of forgotten items (FI) between the initial recall and the second recall; they found that both friends (M = 1.0) and non-friends (M = 1.4) forgot items more than individuals (M = .3) in the story recall condition, but the mean forgotten item count between friends and non-friends did not significantly differ. Similar the error data for the word list condition showed friends (M = 1.8) and non-friends (M = 1.8) forgetting more items than individuals (M = .8); again, the friends and non-friends mean forgotten item count did not significantly differ (Andersson & Rönnberg, 1995). These results imply that although dyads recalled more items than individuals they also forgot more of those items when working together compared to the individuals (Andersson & Rönnberg, 1995).

Weldon and Bellinger (1997) established the use of nominal groups as the critical comparison for determining the existence of collaborative inhibition. Weldon and Bellinger (1997) performed two experiments to analyze how participants remembered collaboratively or individually—later the data from the individuals' recollections were randomly paired to form nominal groups. All participants were tested in groups of three and recalled on two successive

tests, without an intervening study period. In Experiment 1, Weldon and Bellinger (1997) manipulated group type at recall, collaborative or individual, and level-of-processing by having participants encode pictures and words with either a deep or shallow level of processing. For example, in the shallow-encoding condition participants were presented with a slide of either a picture of an object (e.g., grapes) or the actual word for that object (e.g., the word "grapes") and were asked to rate the quality of the slide, whether it was crisp, clear, easy to read, on a scale of one to five (one being poor and five being high). For the deep-encoding condition, participants were asked to rate the pleasantness of the object/word on the slide on a scale of one (very pleasant) to five (very unpleasant). The deep-encoding condition encourages semantic processing because participants must think about the meaning of the object/word to make the judgment, whereas shallow-encoding only encourages low-level physical processing of the image. At test, participants were asked to write down all the target pictures and words they saw on a blank sheet of paper; in the case of collaborative groups, one person was designated the recorder and also participated in the collaborative recall of the materials.

Consistent with Andersson and Rönnberg (1995), Weldon and Bellinger (1997) reported that multiple heads recalled more information than one—collaborative groups (M = .48) outperformed individuals (M = .28). More importantly, however, the nominal groups (M = .57) outperformed the collaborative groups (M = .48), which indicates that Weldon & Bellinger (1997) observed collaborative inhibition across both the stimulus type (picture or word) and the level of processing (deep or shallow) conditions. That is, when the number of heads is equated (three per group in this case), the act of collaborating impaired performance relative to a group that did not collaborate during recall (Weldon & Bellinger, 1997). Overall, collaborative inhibition was not observed in only one condition: the shallow level-of-processing for picture

stimuli showed no significant difference between the nominal performance (M = .53) and the collaborative performance (M = .53). Importantly, Weldon and Bellinger (1997) also replicated the benchmark memory phenomena of the picture-superiority and level-of-processing effects—that is, pictures were better recalled than words and deep level of processing resulted in higher levels of recall than shallow processing, but neither of these effects influenced the presence of collaborative inhibition. The presence of these phenomena suggests that we can trust the Weldon and Bellinger (1997) data and we can be confident in the robustness of collaborative inhibition.

In Experiment 2, Weldon and Bellinger (1997) had participants recall from the story, "War of Ghosts" (Bartlett, 1932), which they heard in the form of a recording. The story was divided into 42 units of meaning which were coded as follows: wrong (0); partially correct (0.5), and correct (1). Participants were tested in groups of three in both an oral and a written fashion; participants were tested alone for the individual oral recall phase only. When recalling prose Weldon & Bellinger (1997) observed collaborative inhibition; nominal groups (M = .74) outperformed collaborative groups (M = .59). In other words, Weldon and Bellinger (1997) observed that collaborative inhibition generalized to prose stimuli.

Collaborative Inhibition is Robust with a Variety of Stimuli

Weldon and Bellinger (1997) demonstrated that collaborative inhibition was present when recalling words, pictures, and prose; researchers have found collaborative inhibition in a variety of other stimuli as well. For instance, in the first experiment of Finlay, Hitch and Meudell (2000), participants performed three successive free recall tests for the to-be-recalled information of hidden animals in puzzle pictures. In the cases of collaboration, one participant was designated as the scribe but was also told to help collaboratively recall the material. Participants either encoded, or memorized, what animals they saw alone or with a partner; participants who

encoded with a partner collaborated with that same partner in phase two. In phases one and three the participants always recalled individually; in phase two participants either recalled individually or collaboratively in pairs. Analyses of the second phase revealed that the number of correct items recalled for the individual-encoding collaborating group (M = 17.5) significantly differed from the items recalled by the individual-encoding nominal group (M = 25.3), again demonstrating collaborative inhibition for hidden pictorial stimuli (Finlay et al., 2000).

So far, collaborative inhibition has been demonstrated to have a robust presence when participants recall words (Weldon & Bellinger,1997), pictures (Weldon & Bellinger,1997), prose (Weldon & Bellinger,1997), and visual puzzles (Finlay et al., 2000) regardless of the mode of recall, written or oral. Although excellent experimental materials, none of these stimuli are particularly naturalistic—that is, when people remember together in the real world, they don't remember lists of words, pictures, or puzzles. They tend to remember information that is more social in nature. Reysen, Talbert, Dominko, Jones, and Kelley (2011) were drawn to the idea of exploring the effects of socially-oriented information upon collaborative performance as it is a type of information that humans encode with daily. Reysen et al. (2011) performed three experiments to examine the effects of social and non-social information upon both nominal and collaborative memory performance. For the purposes of their research, Reysen et al. (2011) chose their social or non-social information to take the form of typed passages.

In Experiment 1, four passages were used all of equal length (7-8 sentences; 122-126 words; 23 propositions); two of the passages were social in nature while two were not (Reysen et al., 2011). The social passages described an interaction between two people; the first social passage concerned an affair between a student and a professor while the second passage concerned an email mishap where a student forwarded an inappropriate email about a professor

to the entire class as well as that same professor. The non-social passages did not describe any interactions among people; the first passage described a lone student's hiking experience while the second described the experience of a cicada's transformation from nymph to adult. Participants recalled either individually (for later use in nominal groups) or collaboratively. When analyzing the participant's response, two raters determined which of the 23 propositions were accurately recalled, which resulted in a point being awarded. The raters utilized a lenient scoring criteria and awarded credit if the general idea of a proposition was expressed.

As predicted, the social passages (M = .52) were recalled significantly better than the non-social (M = .42) passages and collaborative (M = .44) performance was significantly lower than the nominal (M = .50) performance (Reysen et al., 2011). However, the mnemonic benefits of social information were not strong enough to eliminate collaborative inhibition as collaborative inhibition was observed even in the recall of the social passages (Reysen et al., 2011). The researchers then performed a second experiment with the intention of expanding and replicating their findings (Reysen et al., 2011).

Experiment 2 manipulated the type of social information (gossip vs. non-gossip) and the social relationships (implicit vs. explicit) present in passages while comparing their effects upon collaborative memory (Reysen et al., 2011). For example, the gossip passage might contain a person cheating on a spouse while the non-gossip passage might contain a day in the life of a college student. The implicitly social passages did not contain direct interactions between people while the explicitly social passages did contain direct interactions between people. Experiment 2 used same procedure and scoring criteria as did Experiment 1. As predicted, Reysen et al. (2011) found that significantly more gossip type information (M = .71) was recalled than non-gossip type (M = .57) and that significantly more explicitly social (M = .69) information was recalled

than implicitly social (M = .59) information (Reysen et al., 2011). Again, the nominal group (M = .69) outperformed the collaborative group (M = .58) and collaborative inhibition was present in every combination of social information and gossip type (Reysen et al., 2011). However, Reysen et al. (2011) discovered a possible confound being level of interest that might explain the relationship between explicitly and implicitly social information—that the explicitly social passages may have simply been more interesting than the implicitly social passages and thus easier to remember. The researchers then devised a third experiment which confirmed that interest and gossip are both separable mnemonic benefits that enhance memory performance, but, again, neither of these mnemonic benefits were sufficiently strong to combat the negative effects of collaborative inhibition (Reysen et al., 2011).

To follow-up on Reysen et al. (2011), Kelley, Reysen, Ahlstrand, and Pentz (2012) simplified the manipulation of social information: participants read sentences with social and nonsocial words (e. g. “Daisy” vs. “The daisy”; social and non-social, respectively) which would be recalled later with a surprise recall of the target words. After being presented with all of the sentences, half of which contained names or social words with the other half containing the same nonsocial versions of the words, participants were asked to recall the targeted words either alone or collaboratively with another. As expected the social (M = .50) words were recalled more frequently than the nonsocial (M = .33) words (Kelley et al., 2012). However collaborative inhibition persisted as nominal (M = .49) performance was greater than collaborative (M = .36) performance (Kelley et al., 2012). Overall, social expertise was not found to moderate collaborative inhibition—the phenomenon is robust and difficulty to attenuate or eliminate.

Collaborative Inhibition is Robust with a Variety of Group Size & Compositions

Collaborative inhibition has been demonstrated in pairs (e.g., Finlay et al., 2000; Reysen et al., 2011; Kelley et al., 2012) and groups of three (e.g., Weldon & Bellinger, 1997) when their performance is compared against that of nominal groups of the same number of group members. For instance, Dahlstrom, Danielsson, Emilsson, and Andersson (2011) performed an experiment with dyads, groups of two, where participants were to recall organized word lists. Dahlstrom et al. (2011) to no surprise observed collaborative inhibition between the nominal (M = .67) and collaborative conditions (M = .62). Undoubtedly collaborative inhibition occurs in pairs but does the magnitude of the effect differ between various group sizes—that is does a larger group size result in more collaborative inhibition than a smaller group size or vice versa? To examine this question of group size behavior as a moderator Basden, Basden and Henry (2000) performed two experiments in which the performance of groups of four members was compared to groups of two members. For the purposes of Basden et al. (2000), nominal groups composed of four individuals were used in all comparisons. In Experiment 1, participants studied categorized word lists and were tested in groups of one, two, or four individuals. Basden et al. (2000) found that the mean proportion of words correctly recalled was highest for nominal groups (M = .52) and the two-person collaborative groups (M = .48) while being the lowest for the four-person collaborative groups (M = .44). A significant difference was found between the nominal groups and the four-person groups while the difference between the two-person groups did not significantly differ from either (Basden et al., 2000). However, as Basden et al. (2000) did not use two-person nominal groups in their comparisons meaning that two-person collaborative groups were compared to the collective performance of four individuals. Interestingly enough

however the two-person groups still did not perform significantly worse than the collective performance of four individuals.

Group size does not appear to affect the presence of collaborative inhibition; simply the act of collaboration is enough to harm group performance. Most of the research presented so far involves pairing strangers, having them engage in collaboration and documenting collaborative recall. Could collaborating with someone you know better result in better collaborative performance, as you are more likely to have experience recalling past events with your friends? Harris, Barnier, and Sutton (2012) addressed this question and designed two experiments to examine whether the type of relationship between participants would affect the presence of collaborative inhibition upon memory recall. In Experiment 1, the effects of shared encoding and unshared encoding upon collaborative memory performance of word lists between strangers was analyzed. The groups both collaborative and nominal consisted of three individuals. Harris et al. (2012) observed collaborative inhibition; when strangers encoded the word lists separately the nominal (M = .88) groups outperformed the collaborative groups (M = .67) demonstrating collaborative inhibition had been observed. Neither the group size of three nor the relationship between the strangers was able to counterbalance the negative effects of collaborative inhibition.

Experiment 2 replicated Experiment 1 with the added manipulation of friendship between the participants; the majority of the participants used (61%) had known each other and been friends for six months to two years (Harris et al., 2012). For the purposes of their experiments, the groups were again in threes and the to-be-recalled information consisted again of word lists. Harris et al. (2012) found the same results as before—that is when friends encoded separately collaborative inhibition was observed; the nominal groups (M = .90) outperformed the

collaborative groups (M = .78) when friends encoded separately. Harris et al. (2012) did not observe friendship to counteract the negative effects of collaborative inhibition.

Explanations of Collaborative Inhibition

Group work has long been a subject of scientific examination and has its roots in our culture as can be seen in colloquialisms and sayings. For example the two phrases "two heads are better than one" and "too many cooks in the kitchen spoil the broth" provide very opposite summations of the quality of output from group work, but which is more accurate? Well as Andersson and Rönnberg (1995) demonstrated, "two heads are better than one". However, collaborative inhibition demonstrates that collaboration results in a poorer quality of work than does individual performance, or rather "too many cooks in the kitchen spoil the broth". Collaboration does not only exist in a social capacity but also exists in physical capacities with workloads and has previously been studied. In an unpublished work, Ringleman, a German psychologist, observed that individuals could pull a rope at a pressure of 63 kg but surprisingly when that same individual worked with others to pull the rope their work did not meet the standard set by their individual performance (Thompson, 2007). Groups of two pulled the rope at less than twice the original performance and groups of three pulled the rope only two-and-a-half times greater than the original performance (Thompson, 2007).

These observations along with Latane, Williams, and Harkins (1979) replication of these results in hand clapping and shouting led to the development of a phenomena called *social loafing*, or rather that the sum of individual performance is greater than group performance (Thompson, 2007). Although physical collaboration does not operate in the same capacity as does social collaboration, Weldon, Blair, and Huebsch (2000) assessed whether social loafing could be responsible for collaborative inhibition. Across five systematic experiments, Weldon et al. (2000) manipulated incentives, accountability, and group cohesion and determined that social loafing was not a source of collaborative inhibition.

The leading explanation of collaborative inhibition is the *retrieval strategy disruption* (*RSD*) *hypothesis* (Basden, Basden, Bryner, & Thomas, 1997), which proposes that participants engage in their own unique strategy of encoding, organizing, and then recalling information from their memory. This strategy can be disrupted numerous ways but, in the case of collaborative inhibition, it is specifically disrupted by having another person attempting to recall the same information at the same time with a different (unique to the other person) retrieval strategy (e.g., Basden et al., 1997). Basden et al. (1997) performed four experiments to test their theory of retrieval disruption and found that collaborative groups consistently were outperformed by nominal groups, the same number of people performing individually. Participants were to recall categorized lists in collaborative groups or individually. When the categories were large (M = .49; M = .42) and the category names were provided at recall (M = .54; M = .39) nominal groups outperformed collaborative groups (Basden et al., 1997). When participants retrieved non-overlapping portions of the list to recall (M = .34; M = .31) and participants were forced to use the same recall strategy (category-cued recall; M = .58; M = .60), however, nominal and collaborative groups did not significantly differ. In other words, when strategy disruption was eliminated, collaboration inhibition was also eliminated.

Further support for RSD comes from experiments in which collaborators engage in a *shared encoding* procedure designed to ensure that participants use similar organizational strategies during encoding, which in turn, lead them to shared strategies at retrieval. For instance, Finlay et al. (2000) observed in their first experiment that when the participants encoded and recalled with a partner there was no significant difference between the collaborative (M = 20.8) and nominal scores (M = 21.3); collaborative inhibition was eliminated when participants had similar encoding and retrieval strategies. In their second experiment, Finlay et

al. (2000) manipulated the type of group (nominal or collaborative) and type of recall test (cued or free recall). They reported that nominal pairs outperformed collaborative pairs in free recall, but this significant difference was not observed in the cued-recall condition—collaborative inhibition was observed to be eliminated in cued recall, which is a procedure that ensures a similar retrieval strategy is used by each participant because they have to respond to the same cue at the same time. Specifically, nominal pairs (M = 15.9) outperformed collaborative pairs (M = 11.8) in free-recall conditions, but no significant difference was found between the nominal pairs (M = 16.0) and collaborative pairs (M = 16.3) in the cued-recall conditions (Finlay et al., 2000). Although this suggests that simply changing the type of test is sufficient for eliminating collaborative inhibition, two other studies call this into question. Meade & Roediger (2009) reported that collaborative inhibition was found in both a free recall and cued-recall condition. Moreover, Kelley et al. (2012) observed collaborative inhibition in the cued-recall condition of their experiment and that it did not appear to be weakened.

Consistent with Finlay et al. (2000), Harris et al. (2012) found shared encoding to eliminate the negative effects of collaborative inhibition. In Experiment 1, the effects of shared encoding and unshared encoding upon collaborative memory performance of word lists was analyzed (Harris et al., 2012). Harris et al. (2012) found that when encoding was shared collaborative inhibition was not found; the nominal group (M = .83) did not significantly differ from the collaborative (M = .81) performance when encoding was shared. However, when the encoding phase was performed separately the nominal (M = .88) groups outperformed the collaborative groups (M = .67) demonstrating collaborative inhibition had been observed. In Experiment 2, Harris et al. (2012) replicated their findings in Experiment 1 observing collaborative inhibition when the encoding was not shared and not observing it when encoding

was shared. Harris et al. (2012) are in agreement with Finlay et al. (2000) and claim that the shared encoding results in similar retrieval patterns among the collaborators which eliminates collaborative inhibition.

While similar methods of encoding and retrieval have been shown to negate collaborative inhibition (Basden et al., 1997; Finlay et al., 2000) Meade, Nokes and Morrow (2009) demonstrated that expertise can also eliminate the negative effects of collaborative inhibition. Meade et al. (2009) examined collaborative memory of situations among pilots of varying degrees of expertise: expert pilots, novice pilots, and non-pilots. The participants were presented with either simple or complex aviation scenarios and were asked to recall those scenarios individually or collaboratively with someone of the same expertise level. Again collaborative performance was compared to nominal group performance.

As anticipated a significant main effect of expertise was found with experts (M = .60); experts recalled significantly more than novices (M = .49), and novices recalled significantly more than non-pilots (M = .37) (Meade et al., 2009). When looking at expertise and collaborative recall experts (M = .68) recalled significantly more than novices (M = .46), and novices recalled more than non-pilots (M = .33) in collaborative groups (Meade et al., 2009). More central to the current questions of interest, when comparing the collaborative group performance against the nominal group performance, Meade et al. (2009) found that expertise moderates collaborative inhibition; when aviation experts work together the result is *greater* than their pooled individual performances while aviators with lesser levels of expertise are still affected by collaborative inhibition. In other words, experts showed *collaborative* facilitation: Expert collaborative groups (M = .68) performed better than the nominal expert groups (M = .52). In terms of the RSD hypothesis, the retrieval strategies of experts are unlikely to disrupt other experts and, in fact,

they enhance one another when collaborating. In contrast, novices and non-pilots both showed traditional collaborative inhibition: novice and non-pilots' (M = .46; M = .33) collaborative performance was worse than the nominal novice and non-pilots' (M = .51; M = .41) performance (Meade et al., 2009). A high level of expertise led to collaborative facilitation or the improved performance of individuals when working in a group.

Although the RSD hypothesis is the leading candidate for accurately explaining why collaborative inhibition occurs, it is far from perfect. Despite being able to explain most data from existing studies fairly well, there is an inherent circular motion within the RSD hypothesis which is its major flaw. When collaborative inhibition is demonstrated, according to the RSD hypothesis, it is due to conflicting retrieval strategies which disrupt the retrieval; however, when collaborative inhibition is not observed, it is due to the congruence of the strategies and their non-disruptive nature. Simply put, the RSD hypothesis is difficult to falsify as the theory effectively explains both collaborative inhibition and the lack thereof; this is concerning especially when regarding the circularity of the theory and the lack of a precise definition of the "strategies" that are mentioned in Basden et al. (1997). Furthermore, future research concerning the RSD hypothesis should focus more upon clarifying and defining these retrieval strategies as well as making a priori predictions about their nature, as called for in Kelley, Pentz, and Reysen (2014).

Collaboration in Collaborative Contexts: Drama & Improvisational Comedy

Most of the research presented thus far analyzed collaboration within behavior that does not occur habitually or in natural environments (e.g. remembering categorized word lists or prose passages) with the exception of Reysen et al. (2011), who had participants recall information that was socially-oriented (e.g. typed passages of an affair between a student and a professor).

However, even this type of stimulus has its limitations when compared to the habitual memory recollection of individuals; this stimulus still consists of a typed passage, albeit a social one, that was contrived for experimental purposes and separate from the participants' subjective experience. In fact, to date, researchers have not explored the effects of collaborative inhibition in contexts that explicitly depend upon collaboration for successful encoding and retrieval.

In an effort to examine collaboration's effects in a more naturalistic collaborative context, the present research examined how collaboration affects the recollection of improvised material. In this situation, collaboration is of central focus to the entire task because participants generate the material together in the moment. Following the shared generation of the to-be-remembered material, participants can be asked to recall collaboratively or individually (for use later nominal groups) to assess whether collaboration influences retrieval in this task. Unfortunately, the literature currently lacks published research generally concerning improvisation and memory. With this deficit in research concerning improvisation, this research must draw upon a close relative of improvisation that is equally reliant upon collaboration: drama.

Drama is akin to improv in that collaboration is essential to its success; two or more people work together to create an artistic piece that lives within the moment and changes from day to day. The fleeting interpersonal encounters that occur within drama are the same as in improvisational theatre with the only difference being the lack of a script for the latter, much like any personal encounter in real life. Therefore, it is logical to study improvisation as naturalistic stimuli and examine how collaboration alters the memory recollection process. The following paragraphs will briefly review key research in drama to help establish the new methods of the current studies.

A husband and wife team, Noice and Noice, have conducted a number of experiments over the past 20 years honing their theory of how exactly professional actors are able to memorize and retain entire plays (e.g. Noice & Noice, 1992; Noice & Noice, 1993; Noice & Noice, 2002b; Noice & Noice, 2004). Through their intimate research with professional actors, they have credited actors' extensive and extended knowledge of plays to come from a concept they call *active experiencing (AE).* AE is the process through which actors take on the feelings, circumstances and motives of a character to more fully experience that character (Noice & Noice, 1992). For example, in *Doubt: A Parable,* Father Flynn pleads with Sister Aloysius to not spread information regarding his condemning past. According to the AE model, the actor playing Father Flynn in this situation would need to genuinely plead for forgiveness, not simply imitate pleading (Noice & Noice, 1992). Furthermore, the actor would define the actions of the character's past that Father Flynn was so ashamed of because it was not information given in the play. Through this process of actively and genuinely experiencing the characters' goals, thoughts, and feelings, the content of the script becomes memorized. Noice and Noice (2002a) found that actors effectively memorized their roles as a result of their intensive strategies which were the basis for the AE model and that the retention of that material was extremely high; actors accurately remembered 87% of their lines seven years after ceasing to play the role and 50% after 28 years. Noice and Noice (2004) also found when older adults, who are at risk for cognitive and memory decline, were instructed upon techniques designed to evoke active experiencing that it improved their overall memory recollection and cognitive ability.

Noice and Noice (2001) adapted their concept of AE into a strategies designed to help students retain dramatic plays for English and drama classes, with three groups of students. The first group used the full active experiencing strategy which included movement along with

genuinely embracing the characters' goals, feelings, and desires; if the play called for a character to scream in the face of another character the students did so. The second group used a partial active experiencing strategy that allowed everything except movement—that is, the students were restricted to their chairs but allowed to genuinely embrace their assigned characters. The last group employed a deliberate memorization technique but was given no specific strategies. They found that the students in the full AE condition outperformed the other two groups at all levels of accuracy: verbatim, acceptable verbatim (which allowed very minor deviations), and total recall (which included paraphrasing).

Although scripted drama is very different from improvisation, actors do improvise. In fact many actors, both professional and amateur, commonly employ improvisation as a tool; actors improvise within their character's circumstances to generate material for fictitious events that are often referenced in a play but never seen onstage. In contrast, true improvisers are required to actively listen to what is being said by their scene partners; it is through this active listening and collaboration that improvisation is successful. Noice & Noice's theory of AE involves time studying the script, often answering goal oriented questions from the character's perspective (e.g. Q: Why is Father Flynn pleading with Sister Aloysius? A: She will ruin my career if she speaks of my past.). However, in a full improvisation context, there is neither a script nor time to analyze the dialogue in this way, so the improvisers must do so on the fly while generating a response that is congruent with their partner's offer (e.g. Partner's offer: Doctor, we have a flat tire! Response: Yes, Igor. That is why I called AAA) which would increase the difficulty of encoding the scene. Noice and Noice (2009) argue that AE is successful due to the effort it takes to encode the material—generating elaborations to goal-oriented questions about the character's actions is difficult and requires a deeper level of processing than simply

memorizing the text. Based upon Noice and Noice's (2009) reasoning, then, it is feasible that improvising with a partner when actively engaged in a character would require a deep level of processing and thus facilitate memory recollection through collaboration.

Improvisation is unique, however, in that it is entirely participant-generated—that is, the content is new and varies from person to person and from scene to scene. Using improvisation as a stimulus thus creates difficulties that would otherwise be absent. For example, much of the research presented thus far utilized categorized word lists as stimuli, with the word either being recalled or not recalled. To effectively code improvisation and test for accurate recollection there would need to be very specific criteria for awarding credit of correct recall, as a universal key is not only infeasible but also impossible, as the content would change from group to group and from condition to condition. To generate an effective strategy for encoding improvised dialogue into useable empirical data, all dialogue was broken down into basic units of meaning or *idea units* (e.g., Noice & Noice, 2009). Noice and Noice defined idea units as "any group of words expressing a complete thought" as plays frequently include a series of fragmentary responses or interrupted speech (2009, p.153). Therefore for the purposes of this research, the percentage of idea units correctly recalled was measured.

Present Study: Improvisation & Collaboration

The present study included two experiments. The purpose of Experiment 1 was to examine the effect of collaboration upon the recall of improvised dialogue. Recall type (collaborative vs. individual) was manipulated with the percentage of correct idea units recalled being measured. Given the absence of previous research where the collaborative context was so central to the task at hand, it is difficult to predict how retrieval will be influenced by collaboration. The safest prediction might be collaborative inhibition since this phenomenon has

proven so robust across a variety of manipulations. Then again, past research has shown that shared encoding often eliminates the negative effects of collaborative inhibition (e.g., Finlay et al., 2000; Harris et al., 2012). One could characterize improvisation as an extreme form of shared encoding in which even the generation of the to-be-remembered material is shared. If this is the case, then collaboration might not inhibit memory at all in Experiment 1.

Experiment 2 served a dual function, to replicate and expand upon Experiment 1. In Experiment 2, both recall type (collaborative vs. individual) and gesture type (constrained during recall vs. unconstrained during recall) were manipulated with the same dependent variable being the percentage of idea units correctly recalled. With regard to the gesture manipulation, based on previous research (e.g., Noice & Noice, 2001), we expect that constraining gestures at retrieval should impair performance. Presumably, collaboration should influence memory in a manner that is consistent with the results of Experiment 1. It is unclear whether these two independent variables will interact in a meaningful way.

2. Method

Participants

Twenty introductory psychology students from Lake Forest College participated in pairs for extra credit in their Introduction to Psychology course. Each participant chose which time slot they preferred based upon their availability. Each pair completed two separate experiments with a total duration of approximately 35 minutes

Design and Materials

Experiment 1 had a single manipulation (recall type: individual or collaborative) using a within-subjects design. That is, each participant completed one recall with a partner (collaborative) and one as an individual; the individual recall data were used later to form

nominal groups. Each pair was given a suggestion from the researcher and one minute to perform an improvised scene. The scene began after the first word of the scene was uttered and ended at the one minute mark. Participants were then asked to recall their scene immediately after the conclusion of their scene.

For the individual recall condition, participant A was taken out of the room into a room of similar dimensions across the hall where they were given up to three minutes to recall the scene "as close to verbatim as possible"; participant B remained in the first room and also had up to three minutes to recall the scene. Recall began at the same time for both participants. If one participant finished recalling before the other they were asked to wait patiently in their respective rooms. For the collaborative recall condition, the participants were asked to recall the scene together immediately following the conclusion of their scene "as close to verbatim as possible" and had up to three minutes to do so. Generally, participants required 90 seconds or less to recall their one-minute scene regardless of recall condition. The conditions were counterbalanced so that an equal number of participants recalled their first scene collaboratively or individually.

Experiment 2 occurred immediately after the conclusion of the first experiment. The second experiment employed a 2 (recall type: individual vs. collaborative) by 2 (gesture type: unconstrained vs. constrained) within-subjects design. The gesture manipulation allowed either the free use hand gestures and movements during recall (unconstrained) or no hand gestures allowed during the recall phase (constrained). A hand gesture was defined as any gesture that participants used when performing their scene whether to reinforce an explanation, act out an action, or simply function as conversational hand gestures. In the constrained condition, participants stood with their feet in boxes traced upon the floor, roughly one shoulder width apart, with painter's tape and grasped a marker with both hands behind their backs during the

recall phase of the condition. In the unconstrained condition, participants stood in the same spots, but did not hold a marker and were instructed that they could move their hands freely. The conditions were counterbalanced across participants to reduce any potential order effects of recall type and constraint type.

All performance and recall sessions were recorded with two Kodak Playsport Zx3 cameras, one camera for each room, which made video and audio recordings. The cameras were mounted upon tripods approximately three feet high. Each camera was placed about four feet from the participants and recorded the participants from the waist up. Participants performed and recalled within a square traced out in painters tape upon the floor to ensure they were properly recorded by the camera; the approximate dimensions of each square was four feet by five feet.

Procedure

All participants began each session by "warming up". In improvisation and any form of performance art, it is common and recommended that performers "warm up" to give their body time to prepare both mentally and physically for what is to come. Participants first engaged in a common exercise with the experimenter aimed to get the performers' "energy" up called the "shake out". For a complete description of the shake-out please consult Appendix A. The participants then completed an exercise designed to mentally prepare for the scenes to come and also to explain the core principle of "yes and". For a description of this principle and the exercise used to explain it, please consult the Appendix B.

After being sufficiently "warmed up," the participants then performed their first one-minute scene based upon a suggestion provided by the experimenter. Each condition had a separate suggestion so that each pair was given the same suggestion with the same manipulations (for example, in Condition A, participants were given the suggestion of politics and were to

recall their scene individually; whereas, in condition C, participants were give the suggestion of holiday and to recall collaboratively but not allowed to use hand gestures while recalling). Across the two experiments, each pair improvised six scenes—one from each possible condition; as mentioned previously, the order of these conditions were counterbalanced in each experiment. Participants performed their scene for one minute from the point at which they began talking. After the minute passed, participants were asked to recall the scene "as close to verbatim as possible" either individually or collaboratively.

The "warm-up" exercises were not recorded and were only used to prepare the participants for the scene work to follow. In all conditions, a researcher read from a script and informed the participants before each condition if they would be allowed to recall the scene together or apart, that their scene would be one minute long, and whether they were allowed to move about the space as they recalled the scene. Before beginning each scene, participants were told that when the scene was completed the researcher would say "Scene!" and that they would receive a thumbs-up after this word to indicate that they were to begin recalling the scene; this was explained in an attempt to reduce the amount of instructions between the performance and recall phases. As mentioned earlier, each performance and recall session was recorded. During the individual recall phase the experimenter was not in either room with the participants to eliminate excessive noise from entering and leaving the room, and to eliminate the effect of having an experimenter witness the recall of one participant but not the other. In the collaborative condition, the experimenter stayed in the room with both participants while they recalled the scene to eliminate noise from entering and leaving the room.

Data Analysis

The data obtained were scored according to the number of idea units recalled during the task (e.g., Noice and Noice, 2009). Each sentence, phrase, and utterance was broken down into its crucial units of meaning. Article, pronouns, and possessives were not counted as separate idea units. Verb forms were considered separate idea units as were proper nouns, adjectives, adverbs, words conveying agreement or disagreement and colloquial phrases such as "dropping the ball". For example in the statement "yeah, like if you ever want to sleep in your own bed", there are five idea units in this statement: "yeah", "if you ever want", "to sleep", "in your own", and "bed". Frequently participants would use a lot of colloquial language that did not convey any particular meaning; this language was not considered an essential part of the sentence and did not result in points being awarded. For example in the statement "No, you know. Just about 20, 30 minutes away", "you know" was not considered to be important to the meaning of the statement and was not scored as an idea unit, while "no", "just about", "20", "30", "minutes", and "away" were all considered idea units.

Each original scene and then the recall of each scene were recorded to be analyzed later and broken down into idea units by one researcher. When translating the original scenes into idea units, every sentence uttered was transcribed, and each sentence was then broken down into its crucial idea units. Previous literature (e.g., Noice & Noice, 2009) has suggested that when remembering text from plays that the best strategy of memorization usually involved gist memory approaches rather than verbatim approaches; however, for these experiments a verbatim strategy of coding was utilized as the participants were asked to recall their words verbatim and most did so successfully. Therefore, in some cases when participants recalled the gist of what

they or their partner said, they were not credited with points as they did not perform verbatim recall.

3. Results and Discussion

Figure 3.1 displays the mean proportion of correctly recalled idea units as a function of group type (collaborative vs. nominal) for Experiment 1. To determine whether these means differed statistically, a paired-samples t-test was performed and revealed no significant difference between the nominal and collaborative conditions, $t(8) = 1.21$, $p = 0.26$. Specifically, the proportion of idea units correctly recalled by nominal groups (M = .56) did not significantly differ from the collaborative groups (M = .51). Although a significant difference between the collaborative and nominal groups was not observed, there is a clear trend towards collaborative inhibition. Given the small sample size, which was the result of the extremely laborious coding process of the data, the power for this experiment was quite low. This lack of power is most likely the reason for significant collaborative inhibition not being observed given collaborative inhibition's established robustness. Indeed, a simulation showed that these groups would have differed significantly with only 20 participants, assuming the same means and standard deviations. Therefore, one should not confidently conclude that collaborative inhibition was eliminated in this case; collaborative inhibition would likely be expected with a larger sample size.

Figure 3.1 Mean Proportion of Idea Units Correctly Recalled as a Function of Group Type

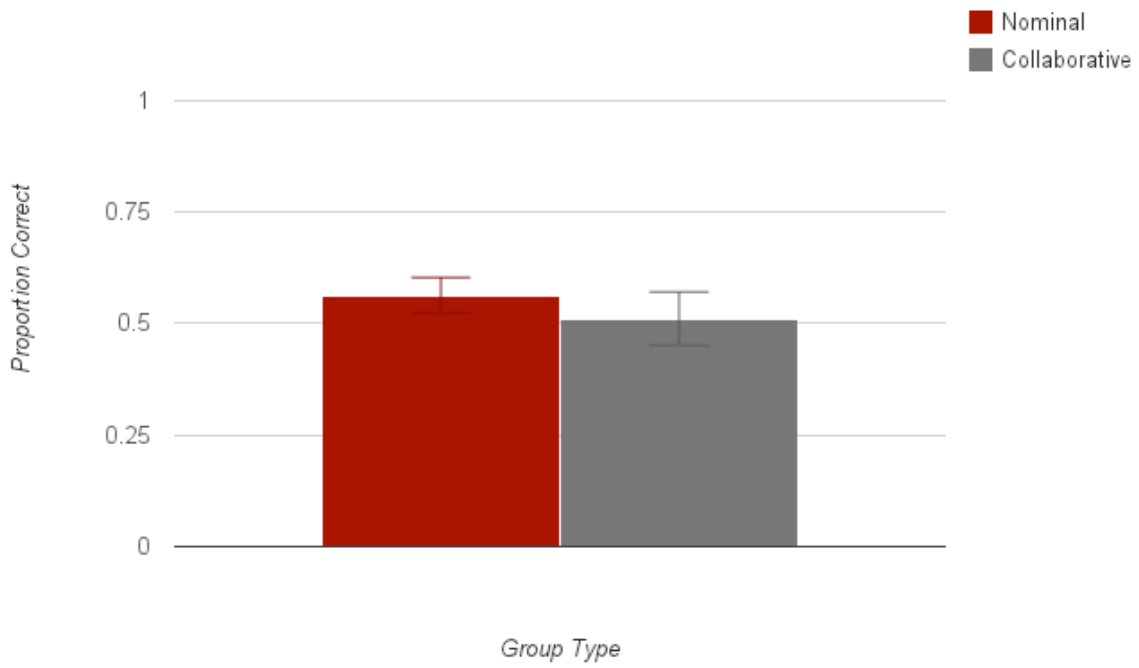
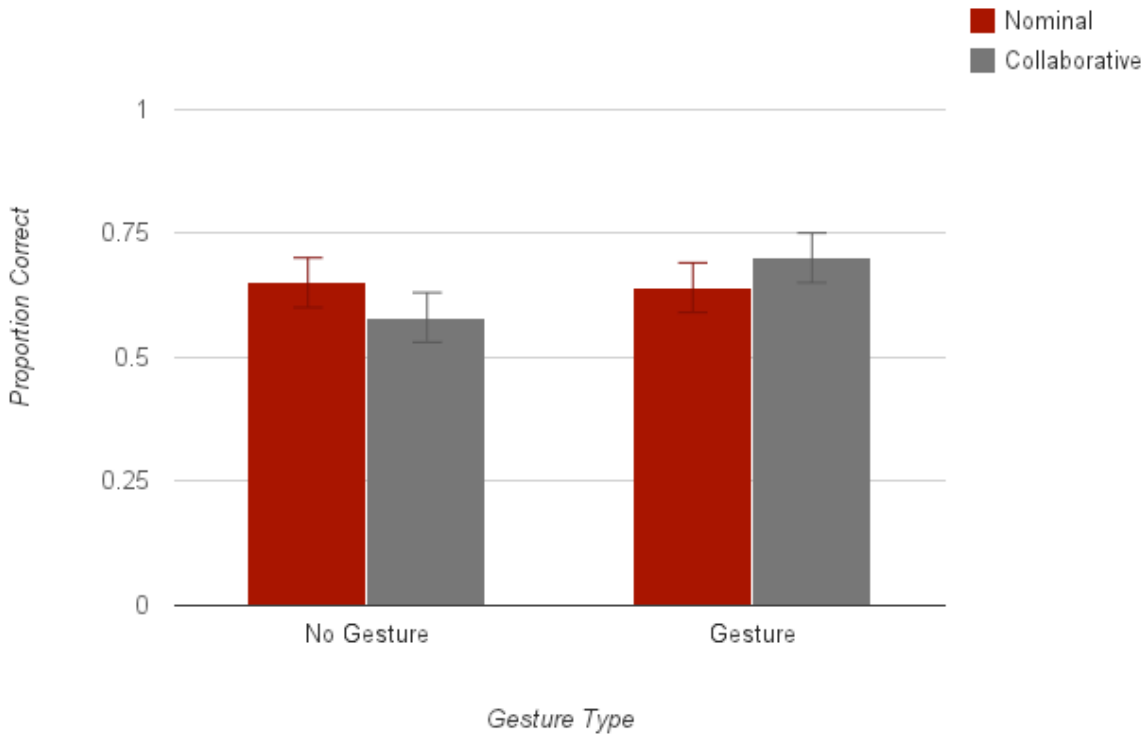


Figure 3.2 displays the mean proportion of correctly recalled idea units as a function of group type (collaborative vs. nominal) and gesture type (constrained during recall vs. unconstrained during recall) for Experiment 2. A 2 x 2 repeated measures analysis of variance (ANOVA) was performed and showed no significant main effects or interactions. Specifically, neither the group type, $F(1,8) = 0.06$, $p = 0.82$, nor gesture type, $F(1,8) = 1.77$, $p = 0.22$, main effect reached significance. Similarly, the interaction between group type and gesture type was also was insignificant, $F(1,8) = 2.34$, $p = 0.16$. Once again, the results suffered from a lack of power as a result of the small sample size. Still, there were two trends in the data that are potentially noteworthy. Previous research indicated that movement does enhance memory and in fact can be crucial to the memory recollection process (Noice & Noice, 2001) and, while not significant, overall performance in the gesture (.67) and no gesture (.61) conditions were in the

predicted direction. Moreover, the pattern of data from the interaction suggests the effects of collaboration might be influenced by the presence or absences of gestures. Interestingly, there seems to be a trend towards collaborative inhibition when gestures are constrained, while there seems to be a trend towards collaborative facilitation with unconstrained gestures. Performing improv could feasibly eliminate the negative effects of collaborative inhibition when participants actively reenact their improvised materials with gestures and movement. Unfortunately, these experiments were unable to fully explore this phenomenon due to a lack of statistical power.

Figure 3.2 Mean proportion of Correctly Recalled Idea Units as a Function of Group Type and Gesture Type



4. General Discussion

To summarize, this study included two experiments. The purpose of Experiment 1 was to examine the effect of collaboration upon the recall of improvised dialogue. Group type (collaborative vs. individual) was manipulated at the recall phase of the experiment. Experiment 2 was designed to replicate Experiment 1 and also determine whether gestures had an impact upon the recollection of improvised dialogue. In both experiments participants generated the material together by improvising a dialogue based upon as single suggestion for each condition. Participants had one minute to improvise their dialogues and up to three minutes to recall the material whether recalling individually or collaboratively. Each experimental condition was visually and orally recording by a camera so that the experimenter could later code the data into idea units and score the recall tests. The concept of idea units was taken from Noice and Noice (2009); each dialogue was broken down into the crucial units of meaning. During the recall phase, participants' recollections were compared against the coded idea units; these experiments utilized a strict method of coding meaning that participants' recollections must exactly match the idea units previously determined.

The results of Experiment 1 failed to find a significant difference between the nominal and collaborative groups; however, a trend towards collaborative inhibition was present. Due to the robustness of collaborative inhibition across a wide variety of experimental designs, it is likely that this experiment failed to find collaborative inhibition due to a lack of power resulting from a small sample size. Hence, the conclusions one can draw from Experiment 1 are limited. The results of Experiment 2 also failed to find any significant main effects for group type (nominal vs. collaborative) or gesture type (constrained vs. unconstrained) and these variables

did not interact significantly. However, there appeared to be a noteworthy trend with regard to gestures: when participants were able to utilize gestures during recall, a trend towards collaborative facilitation became apparent, while a trend towards collaborative inhibition becomes apparent when gestures were constrained during the recall phase. If this finding bore out with a larger sample size, it would suggest that the use of movement and gestures that are used during the encoding phase, the improvising phase, are crucial to the success of collaboration during the recall phase—a finding that would be supported by past evidence which demonstrated that movement was crucial to the successful recollection of scripted material in students (Noice & Noice, 2001). Unfortunately the causal implications of these experiments are limited due to a lack of statistical power, which occurred due to the extremely laborious coding and scoring process and the inability for pairs of participants to actually show up for the experiment.

As mentioned earlier, the leading explanation of collaborative inhibition is the *retrieval strategy disruption* (RSD) hypothesis, which proposes that participants engage in their own unique strategy of encoding, organizing, and recalling the information from their memory (Basden et al., 1997). This strategy can be disrupted in a variety of ways but, in the case of collaborative inhibition, it is specifically disrupted by having another person attempting to recall the same material at the same time with a different (unique to the other person) retrieval strategy (Basden et al., 1997). The RSD hypothesis has been able to account for collaborative inhibition observed with word lists (e.g., Basden et al., 1997), pictures (e.g., Weldon & Bellinger, 1997), prose (e.g., Weldon & Bellinger, 1997), large passages of text (e.g., Reysen et al., 2011), and problem-solving scenarios (e.g., Meade et al., 2009). RSD also explains the elimination of collaborative inhibition when the participants shared encoding, which ensured similar organization and retrieval strategies among the participants (e.g. Finlay et al., 2000).

How does the RSD hypothesis account for the current findings? For the sake of argument, let us assume that the null results reported across the present experiments are true: collaborative inhibition is eliminated with improv and gestures do not influence memory or collaboration. Then, RSD would likely argue that participants shared encoding during the improvisation phase, which minimized disruption at retrieval. Now, let us imagine that the non-significant trends are to be believed: collaborative inhibition in Experiment 1 and collaborative facilitation with gestures in Experiment 2. The RSD hypothesis would explain the aforementioned findings by claiming that the participants in the collaborative group utilized incongruent retrieval strategies which ultimately harmed their memory performance when compared to the performance of the nominal groups. However, in Experiment 2 the opposite can be claimed based upon the discovered trend towards facilitation; using an encoding strategy that relied upon physical gestures and movement facilitated performance—that is, gestures during encoding and recall resulted in collaborative facilitation. The RSD hypothesis would likely attribute the gestures and movement to aide in the standardization of the encoding and retrieval strategies employed by the participants which is why performance seemed to benefit from collaboration and result in better performance. However, as was noted previously, the RSD hypothesis is a cyclical theory—meaning that the theory can effectively explain both the presence of collaborative inhibition and the lack thereof. When collaborative inhibition is not found it is attributed to congruent retrieval strategies; when collaborative inhibition is present it is attributed to incongruent retrieval strategies. The aforementioned reasoning makes it fairly easy to argue either way after the fact; meaning it is untestable and difficult falsify the theory. The RSD's other main weakness lies in its vague definition of retrieval strategies.

This experiment might be best characterized as a pilot study. Despite their novel questions and approaches, these experiments were far from perfect. Firstly, the data used for these experiments were coded strictly; most relevant research (e.g. Noice & Noice, 2004) utilized a more lenient method of coding that included verbatim, near verbatim, and gist scales. Perhaps the strict method of coding was too strict. For instance, often participants would utter things one way (e.g. "Let's head over to the supermarket to purchase some food.") then recall them a slightly different way without changing the meaning (e.g. "Let's go down to the store and buy some groceries."). The strict style of coding did not award credit for utterances that were changed but held the same semantic meaning; some participants' scores may have been higher due to the strict nature of the scale.

A better definition of "idea units" could have been determined. For the purposes of these experiments, articles, pronouns, possessives, and colloquialisms (e.g. "you know", "um", "like", etc.) were not given separate idea units. This did detract some semantic meaning from statements as if a participant originally stated "Bob's dog Ziggy went on a walk by my house" then recalled that statement as "Bob walked his dog by my house" the only idea units shared by the two statements, based upon the criterion establish earlier, would be "Bob", "dog", "Ziggy", "by my house" despite the two statements sharing roughly the same idea that Bob and his dog walked past my house. The coding was also performed by one researcher, meaning that observer bias could be a concern and interrater reliability did not exist. Performing the transcription of every one-minute long dialogue, then converting these into idea units, then scoring the recalled scenes according to the idea unit rubric was extremely time-consuming for one person and, due to a lack of funding, a second person could not have been hired to assist with the coding and scoring. Lastly, the coding process was sometimes hindered in that participants would mumble during the

improvisation phase, meaning the researcher had no notion of whether information had been spontaneously created or correctly recalled in some cases. This could have been corrected with better video and audio equipment, but again, there was no budget for this research.

These experiments were designed to gauge how collaboration affected the recollection of improvised *scenes*. Unfortunately most of the participants engaged in improvised *dialogues* concerning their own lives (e.g. their family history), preferences (e.g. what their favorite sandwiches were), and daily routines (e.g. woke up, went to class, etc.). That said, these studies did not adequately assess the interaction between improvisation and collaboration; this study assessed the relationship between collaboration and participant-generated data, in the form of improvised dialogues. One reason participants may have veered away from performing improvised scenes could be due to the caliber of the suggestions. The suggestions were one word utterances (e.g. family, politics, etc.) that came from the researcher and were meant to stimulate material for an improvised scene. Most of the suggestions failed to instigate a scene but rather led to a normal dialogue between the participants for each pair. Future suggestions should perhaps be more situational; for example, the suggestion *break up* created more improvised scenes than any other suggestion, implying that the situational context associated with the suggestion *break up* was stronger than that of other situations such as *politics* and *Starbucks*. That being said, the vast majority of the pairs still only generated dialogue when prompted with *break up*; perhaps the participants were too inexperienced in improvisation.

Another possible problem with the suggestions used was that each condition shared the same suggestion, meaning there was no counterbalancing to ensure that a suggestion type effect did not occur. Of particular interest was the difference between the collaborative gesture condition and the collaborative no gesture condition; the collaborative gesture had the suggestion

of *family* whereas the collaborative no gesture condition had the suggestion of *sandwich shoppe;* it is possible that the suggestions were responsible for the observed differences between means and that the trend towards collaborative facilitation when collaboration is accompanied by gestures was an artifact. To ensure that a suggestion type effect is not present, future studies should counterbalance suggestions for conditions or have each suggestion be equated in content (e.g. family brings into mind one's family, pets, and history which one could argue is easier to remember than various favorite sandwiches and sandwich stores).

Research that deals with collaborative inhibition can be at risk to testing and fatigue effects. When participants engage in a similar task multiple times, their experience and ability to perform that task increases, a phenomena known as testing effects. By having the order of the conditions counterbalanced, or the order of the conditions varying from participant to participant, testing effects were effective minimized to negligible amounts that no longer confound the data. These experiments utilized counterbalancing in the order of the conditions for just that purpose—that is to ensure that testing and fatigue effects affected all conditions relatively equally. Similarly to testing effects, fatigue effects also increase with the amount of conditions that a participant performs but instead of overall performance being enhanced due to the repetition of tasks, the overall performance is hindered due to fatigue and mistakes that are associated with fatigue. Fatigue and testing effects were adequately combated and should not account for any differences between the conditions.

Each pair of the participants participated in "warm-up" exercises which were performed with the intention of raising the participant's energy and performing a crash course in basic improvisational techniques. This "warm-up" session ranged from five to 10 minutes and clearly was not long enough to educate the participants in the basics of improvised scenework. On the

continuum of expertise, the vast majority of the participants used in these experiments were drastically closer to the non-improviser end, as compared to amateur or even professionals. This level of expertise might be important to consider since Meade et al. (2009) demonstrated that non-experts and novices experienced collaborative inhibition while experts did not. Future studies should directly examine expertise and its relationship with improvisation and collaboration.

Originally these experiments were designed with the notion of including a third experiment which included manipulations to expertise, group recall, and gesture restriction. In this third experiment, there would have been a non-improviser group (e.g. introductory psychology students), a novice group (e.g. students from an introductory improv class held on campus halfway through the class) and an expert group (e.g. professional improvisers from Chicago) with the intention of manipulating group type (e.g. collaborative vs. nominal) and gestures (e.g. constricted vs. non-constricted). Unfortunately due to lack of funding, time, and other logistics (e.g. recreating a testing environment in downtown Chicago and in Lake Forest, IL) this third experiment was unable to be performed. If this third experiment were to have been performed, the researchers would expect to see the same trends found in Experiments 1 and 2—that is, a trend towards collaborative facilitation with gestures and a trend towards collaborative inhibition when gestures are not emphasized. However, it would be interesting to see how expertise influences collaboration on the recollection of improvised material. It would be expected that similar to Meade et al. (2009), expertise in improvising ability would moderate the relationship between collaboration and recollection; expert improvisers would be expected to benefit from collaboration while non-experts would be hindered by collaboration. However with the trend towards facilitation found in Experiment 2, would expertise result in better overall

performance through collaboration? Future studies need to be performed to truly determine if gestures play a large role in mediating collaboration's relationship with recalling improvised material and examine if Meade et al.'s (2009) findings translate to an improvised setting.

Clearly there is something unique about improvisational performance; improv is a thriving venue of entertainment and serves as an excellent creation device for artistic pursuits including, but not limited to, comedy performance and dramatic performance. The fact that improv requires the performers to collectively think together, a concept referred to as group mind, makes it unique. Although improv has not been thoroughly explored within the context of collaborative memory, it has been examined and used in treating people who suffer from cognitive decline and memory degradation. Stevens (2009) found that when older adults who suffered from mild dementia took a class that was designed to teach improvisation and stand- up comedy skills, their ability to remember smalls things improved. Stevens (2009) wrote that most of the caregivers remarked how their patients did not know what they had be doing in their class but that it was "something funny" (p.67) and that the patients started to experience positive anticipation for their classes when they previously had no expectations or negative expectations for the class.

More recently a theatre based in Chicago, called Lookingglass Theatre Company (LTC), has teamed up with Northwestern University's Cognitive Neurology and Alzheimer's Disease Center (CNADC) to develop an eight week theatre program designed for persons with early stage memory degradation conditions, such as Alzheimer's (Cognitive Neurology and Alzheimer's Disease Center; 2014). The program relies heavily upon improvisation, which is closely tied to LTC's core philosophy with the major goal of improving the lives of those suffering from these debilitating diseases; although creative interventions like these do not

impede the progression of diseases like Alzheimer's and dementia, this specific program, called The Memory Ensemble, has demonstrated a trend towards improvement in the lives of its participants (CNADC, 2014). The Memory Ensemble's pilot programs have demonstrated that participants have experienced improved self-esteem, less depression, manage the disease and normalize life while fostering social abilities (CNADC, 2014). Clearly The Memory Ensemble and other work [e.g. Stevens' (2009) work with persons suffering from dementia] indicates that improvisation has unique abilities tied to memory (CNADC, 2014). Perhaps a better understanding of why improvisation appears to foster memory could be linked to collaborative memory and ultimately be a field worth pursuing.

References

Andersson, J., Helstrup, T., & Rönnberg, J. (2007). Collaborative memory: How is our ability to remember affected by interaction with others? In S. Magnussen, T. Helstrup (Eds.), *Everyday memory* (pp. 135-156). New York, NY US: Psychology Press.

Andersson, J., & Rönnberg, J. (1995). Recall suffers from collaboration: Joint recall effects of friendship and task complexity. *Applied Cognitive Psychology*, *9*, 199-211. doi:10.1002/acp.2350090303

Bartlett, F. (1932). *Remembering: A study in experimental and social psychology*. New York, NY: Cambridge University Press.

Basden, B. H., Basden, D. R., Bryner, S., & Thomas, R. (1997). A comparison of group and individual remembering: Does collaboration disrupt retrieval strategies? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*, 1176-1189. doi:10.1037/0278-7393.23.5.1176

Basden, B. H., Basden, D. R., & Henry, S. (2000). Costs and benefits of collaborative remembering. *Applied Cognitive Psychology*, *14*, 497-507. doi:10.1002/1099-0720(200011/12)14:6<497::AID-ACP665>3.0.CO;2-4

Cognitive Neurology and Alzheimer's Disease Center, Northwestern University's Feinberg School of Medicine. (2014, March 26). The memory ensemble. Retrieved from http://www.brain.northwestern.edu/support/enrichment/memory_ensemble.html

Dahlström, Ö., Danielsson, H., Emilsson, M., & Andersson, J. (2011). Does retrieval strategy disruption cause general and specific collaborative inhibition? *Memory*, *19*(2), 140-154. doi:10.1080/09658211.2010.539571

Finlay, F., Hitch, G. J., & Meudell, P. R. (2000). Mutual inhibition in collaborative recall: Evidence for a retrieval-based account. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*, 1556-1567. doi:10.1037/0278-7393.26.6.1556

Harris, C. B., Barnier, A. J., & Sutton, J. (2013). Shared encoding and the costs and benefits of collaborative recall. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *39*, 183-195. doi:10.1037/a0028906

Harris, C. B., Paterson, H. M., & Kemp, R. I. (2008). Collaborative recall and collective memory: What happens when we remember together? *Memory*, *16*, 213-230. doi:10.1080/09658210701811862

Kelley, M. R., Reysen, M. B., Ahlstrand, K. M., & Pentz, C. J. (2012). Collaborative inhibition persists following social processing. *Journal of Cognitive Psychology*, *24*, 727-734. doi:10.1080/20445911.2012.684945

Latané, B., Williams, K., & Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. *Journal of Personality and Social Psychology*, *37*, 822-832. doi:10.1037/0022-3514.37.6.822

Meade, M. L., & Gigone, D. (2011). The effect of information distribution on collaborative inhibition. *Memory*, *19*, 417-428. doi 10.1080/09658211.2011.583928

Meade, M. L., & Roediger, H. (2009). Age differences in collaborative memory: The role of retrieval manipulations. *Memory & Cognition*, *37*, 962-975. doi:10.3758/MC.37.7.962

Reysen, M. B., Talbert, N. G., Dominko, M., Jones, A. N., & Kelley, M. R. (2011). The effects of collaboration on recall of social information. *British Journal of Psychology*, *102*, 646-661. doi:10.1111/j.2044-8295.2011.02035.x

Thompson, R. G. (2007). Collaborative and social remembering. In G. Cohen, & M. A. Conway (Eds.), *Memory in the real world* (3rd ed.) (pp. 249-267). New York, NY: Psychology Press.

Weldon, M., Blair, C., & Huebsch, P. (2000). Group remembering: Does social loafing underlie collaborative inhibition?. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*, 1568-1577. doi:10.1037/0278-7393.26.6.1568

Weldon, M., & Bellinger, K. D. (1997). Collective memory: Collaborative and individual processes in remembering. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*, 1160-1175. doi:10.1037/0278-7393.23.5.1160

Appendix A

Condition A: Individual Recall

Facilitator: "Now you will perform a one-minute scene followed immediately by your best attempt to remember that scene as close to verbatim as possible. You will be asked to recall this scene separately—that is, you will be placed in separate rooms and will be asked to recall the entire scene alone. Please recall the scene word for word as close to verbatim as possible. Feel free to move around and use the same actions that you used during the original scene. The timer will start once you begin speaking and will stop when I say "Scene!" After the scene has ended, participant A will be escorted to the room next-door to recall the scene. Please begin to recall the scene when I give you a thumbs-up indicating that you may begin recalling. Your suggestion for this scene is _____. Please begin whenever you are ready."

1 Minute

[*Begin Scene*]
(Begin recording after the dialogue begins and continue for one minute and interrupting the participants if necessary once a minute of dialogue has been said. Please say the following ending the scene)

1 Minute

Facilitator: "Scene! (Escort participant A out of the room, and give them thumbs-up to record return the other participant, and give them thumbs up to record)

[*Record participants while they recall the scene, allowing up to **3 minutes***]

(Bring Participant A back into the original room)

3 Minutes

Facilitator: "Thank you."

Appendix B

Condition B: Collaborative Recall

Facilitator: "Now you will perform a one-minute scene followed immediately by your best attempt to remember that scene as close to verbatim as possible. You will be asked to recall this scene together—word for word—as close to verbatim as possible. Feel free to move around and use the same actions that you used during the original scene. The timer will start once you begin speaking and will stop when I say "Scene!" Please begin to recall the scene when I give you a thumbs-up indicating that you may begin recalling. Your suggestion for this scene is _____. Please begin whenever you are ready."

1 Minute

[*Begin Scene*]
(Begin recording after the dialogue begins and continue for one minute and interrupting the participants if necessary once a minute of dialogue has been said. Please say the following ending the scene)

1 Minute

Facilitator: "Scene!" (Give thumbs-up when you are ready to begin recording)

[*Record participants while they recall the scene, allowing up to **3 minutes***]

3 Minutes

Facilitator: "Thank you."

Appendix C

Condition C: Individual Recall & Sit on Hands

Facilitator: "Now you will perform a one-minute scene followed immediately by your best attempt to remember. You will be asked to recall this scene separately—that is, you will be placed in separate rooms and will be asked to recall the entire scene alone. Please recall the scene word for word as close to verbatim as possible. When recalling the scene please sit on your hands and refrain from standing and using your hands. The timer will start once you begin speaking and will stop when I say "Scene!" After the scene has ended, participant A will be escorted to the room next-door to recall the scene. Please begin to recall the scene when I give you a thumbs-up indicating that you may begin recalling. Your suggestion for this scene is _____. Please begin whenever you are ready."

[*Begin Scene*]

(Begin recording after the dialogue begins and continue for one minute and interrupting the participants if necessary once a minute of dialogue has been said. Please say the following ending the scene)

Facilitator: "Scene! Please remember to sit on your hands while you recall the scene" (escort participant A out of the room, give them thumbs-up to record return the other participant, and give them thumbs up to record)

[*Record participants while they recall the scene seated, allowing up to **3 minutes***]

[*Bring Participant A back into the main room]*

Facilitator: "Thank you."

Appendix D

Condition D: Collaborative Recall & Sit on Hands

Facilitator: "Now you will perform a one-minute scene followed immediately by your best attempt to remember that scene as close to verbatim as possible. You will be asked to recall this scene together—word for word—as close to verbatim as possible. Feel free to move around and use the same actions that you used during the original scene. When recalling the scene please sit on your hands and refrain from standing and using your hands. The timer will start once you begin speaking and will stop when I say "Scene!" Please begin to recall the scene when I give you a thumbs-up indicating that you may begin recalling. Your suggestion for this scene is _____. Please begin whenever you are ready."

1 Minute

[*Begin Scene*]
(Begin recording after the dialogue begins and continue for one minute and interrupting the participants if necessary once a minute of dialogue has been said. Please say the following ending the scene)

1 Minute

Facilitator: "Scene! Please sit on your hands while you recall the scene." (Give thumbs-up when you are ready to begin recording)

[*Record participants while they recall the scene, allowing up to **3 minutes***]

3 Minutes

Facilitator: "Thank you."

Appendix E

Condition E: Individual Recall & Free Use of Hands

Facilitator: "Now you will perform a one-minute scene followed immediately by your best attempt to remember that scene as close to verbatim as possible. You will be asked to recall this scene separately—that is, you will be placed in separate rooms and will be asked to recall the entire scene alone. Please recall the scene word for word as close to verbatim as possible. Feel free to move around and use the same actions that you used during the original scene. The timer will start once you begin speaking and will stop when I say "Scene!" After the scene has ended, participant A will be escorted to the room next-door to recall the scene. Please begin to recall the scene when I give you a thumbs-up indicating that you may begin recalling. Your suggestion for this scene is _____. Please begin whenever you are ready."

1 Minute

[*Begin Scene*]
(Begin recording after the dialogue begins and continue for one minute and interrupting the participants if necessary once a minute of dialogue has been said. Please say the following ending the scene)

1 Minute

Facilitator: "Scene! (Escort participant A out of the room, give them thumbs-up to record return the other participant, and give them thumbs up to record)

[*Record participants while they recall the scene, allowing up to **3 minutes***]

(Bring Participant A back into the original room)

3 Minutes

Facilitator: "Thank you."

Appendix F

Condition F: Collaborative Recall & Free Use of Hands

Facilitator: "Now you will perform a one-minute scene followed immediately by your best attempt to remember that scene as close to verbatim as possible. You will be asked to recall this scene together—word for word—as close to verbatim as possible. Feel free to move around and use the same actions that you used during the original scene. The timer will start once you begin speaking and will stop when I say "Scene!" Please begin to recall the scene when I give you a thumbs-up indicating that you may begin recalling. Your suggestion for this scene is _____. Please begin whenever you are ready."

1 Minute

[*Begin Scene*]
(Begin recording after the dialogue begins and continue for one minute and interrupting the participants if necessary once a minute of dialogue has been said. Please say the following ending the scene)

1 Minute

Facilitator: "Scene!" (Give thumbs-up when you are ready to begin recording)

[*Record participants while they recall the scene, allowing up to **3 minutes***]

3 Minutes

Facilitator: "Thank you."